THE Cane Growers' QUARTERLY BULLETIN

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BUREAU OF SUGAR EXPERIMENT STATIONS

BRISBANE QUEENSLAND

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BUREAU OF SUGAR EXPERIMENT STATIONS
BRISBANE

THE CANE GROWERS' QUARTERLY BULLETIN

ISSUED BY DIRECTION OF THE
SUGAR EXPERIMENT STATIONS
BOARD

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This Bulletin is an official publication of the extension service of the Bureau of Sugar Experiment Stations, issued and forwarded by the Bureau to all cane growers in Queensland.

The Cane Growers' Quarterly Bulletin

VOL. XXV. JULY 1, 1961 No. 1

EDITORIAL

Chemicals or Machines for Weed Control?

Within a short fifteen years world agriculture has had the exciting experience of considering whether new evolutionary methods were outdating farm implements for weed control. New names and terms such as 2, 4-D, hormone-type, pre-emergence and translocation have entered the everyday discussion of such a mundane farm chore as killing weeds.

There is no doubt that this flood of new agricultural chemicals has opened new vistas, made possible the control of unwanted weeds in a crop like wheat where mechanical control is impossible, and made more vulnerable many of the more persistent weed species.

There is also no argument regarding the ease and rapidity of applying such weedicides by boom spray or by aeroplane or helicopter. And it is now possible to kill many weeds in advanced sugar cane fields which could otherwise be eradicated only with a chipping hoe.

But Queensland canegrowers have been reluctant to pin their faith in chemical weed control to the extent of substituting it for mechanical methods, except for specialised applications. This is due in part to the occasional, unexplainable breakdowns which occur; but also to the fact that, being in a business where costs are a prime factor, the price of weedicide plus application is weighed against the use of a high-speed, high-clearance tractor—and frequently to the advantage of the latter. But the picture is changing every year and, by 1965, the wheel may have turned a lot further.

Soldier Fly Experiments†

By R. B. MOLLER

Introduction

The early history of the poor ratooning investigations at Bundaberg has been recorded elsewhere [3]. Observation and examination of affected fields indicate that the soldier fly, *Metaponia rubriceps* Macq., plays a major role in causing poor ratooning in this district. This has been further supported by recent trial work in which improved ratoons have followed an appreciable reduction in soldier fly populations. Information so far obtained is somewhat inconclusive and conflicting, but general trends have been established.

Trials

Previous observation on the life history of the soldier fly in Bundaberg [1, 2] have indicated an emergence period extending from April to early June. During 1960 emergence occurred as early as mid-March. No evidence of emergence at other times has been obtained. From a study of the known life cycle, the egg-laying to early larval stage appeared the most vulnerable. A number of trials were established during 1958 and 1959 with insecticides lightly worked into the soil surface, before, during and after egg-laying was expected to occur. A blanket coverage of treated plots was achieved.

Results from a portion of one of these trials (trial 1) harvested in 1959 were very promising. Because of harvesting restrictions the major portion of this trial was not harvested until 1960 while the ratoon portion, i.e., cut in 1959, was left to standover until 1961. The ratoon from the standover plant crop clearly demonstrated the superiority of 8 lb per acre BHC* dressings over the other treatments. Four pounds per acre BHC plots were only fair, while 4 lb aldrin and 2.4 lb dieldrin plots were much inferior to the standard.

In connection with this trial, there is a likelihood of the portion standing over not being required for the 1961 harvest; consequently, since one of the 8 lb BHC plots is situated against a headland with a control plot adjacent, both were harvested in 1960 and allowed to ratoon. The growth of the ensuing second ratoon is again very much in favour of the treated plot which in the first ratoon crop yielded 28 t.p.a. compared with 8 t.p.a. for the control.

In another 8 × 4 randomised trial (trial 2) established on similar red forest soil, the clear superiority of ratoons following an initial treatment of 8 lb BHC per acre and to a lesser extent of 4 lb BHC per acre, was again demonstrated. In this trial cane in the four BHC plots ratooned much more quickly and uniformly than did that in the rest of the field, but the difference between plots is not now so obvious. In particular, some of the 8 lb aldrin and 4.8 lb dieldrin plots appear to be quite good. Others, however, are not very satisfactory.

Three other trials on alluvial soil were harvested during 1960—one as a first ratoon, two as second ratoon. In the first ratoon trial (trial 3) plots treated with 8 lb BHC, 8 lb aldrin and 4.8 lb dieldrin produced good ratoons, in all cases superior to the controls. Two plots of 8 lb aldrin in a second ratoon trial (trial 4) were superior to both 8 lb BHC plots although the latter were quite satisfactory. Both treatments were superior to the controls.

The fifth trial from which promising results were obtained incorporated both ploughed-under and disced-in

†A paper submitted at the 28th Conference of the Queensland Society of Sugar Cane Technologists.

*Where mentioned in the text, rates of application of insecticides refer to the gamma isomer and the active ingredient of aldrin and dieldrin.

dressings of BHC and aldrin. The ploughed-under material was applied and disced-in on 12th May, 1958 and subsequently ploughed-under on 19th May, 1958, while the surface dressings were applied on 7th August, 1958. In this trial combination dressings of 4 lb + 2 lb (ploughed-under + disced-in) and to a lesser degree 4 lb + 4 lb of both aldrin and BHC were superior to control, 0 + 2 lb, 0 + 4 lb, 2 + 2 lb, and 2 + 4 lb plots. However, the aldrin treatment was superior to BHC in the 4 + 2 lb and 4 + 4 lb plots.

All plots in all trials were graded visually for ratooning, vigour and stand on a 0—10 scale. Average

TABLE 1—Visual gradings of trials

Treatment per acre	Grading			
	Trial 1	Trial 2	Trial 3	Trial 4
Control	5	6	6	5
BHC 8	9	9	9	8
BHC 4	7	7	–	–
BHC 2	3	–	–	–
Aldrin 8	–	6	8	9
Aldrin 4	3	6	–	–
Aldrin 2	3	–	–	–
Aldrin 1	2	–	–	–
Dieldrin 4.8	–	6.5	9	–
Dieldrin 2.4	4	5	–	–
Dieldrin 1.2	4	–	–	–
Dieldrin 0.6	2	–	–	–

TABLE II—Ploughed-under and disced-in trial

	Treatment per acre												
	Control	Aldrin						BHC					
		0+2	0+4	2+2	2+4	4+2	4+4	0+2	0+4	2+2	2+4	4+2	4+4
Grading	4	4	4	4	5	9	8	7	4	4	4	8	7

grades for the trials 1—4 are given in Table 1.

Table II gives the gradings for the combination ploughed-under and disced-in trial:—

These gradings clearly indicate the superiority of the heavy BHC dressings in all trials.

An attempt was made, also, to obtain counts of larvae from average stools from all plots. These figures were very variable, probably because the sample size was inadequate. However, in all cases the population of 8 lb BHC plots was very low or else larvae were entirely absent, e.g., in trial 1 the three BHC plots averaged 5 larvae while other stools, often in adjacent plots, yielded 506, 464, 354, and 217. In trial 2, one 8 lb BHC plot yielded 9 larvae, none was obtained from the other three plots, while controls averaged 28 larvae per stool.

A number of interesting observations and tentative conclusions can be drawn from these trials. Of prime importance is the apparent effectiveness of BHC broadcast and disced into the soil surface prior to planting. Results from one trial indicate that plouged-under dressings may also be effective. There also appears to be considerable latitude in the timing of this application, since the results of

trials 1—4 above (Table 1) were obtained from treatments applied on 26th February, 28th May, 7th August, and 12th August. Furthermore, it appears that a dressing applied prior to planting will give protection for a plant crop and two ratoons at least.

Further Trial Work

Trials established during 1960 were based on the response to 4 lb and 8 lb BHC obtained in 1959. These trials were established primarily to determine:—

The importance of time of application of insecticides.

Whether the treatment would be best applied as a pre-planting or post-planting operation.

The best method of incorporating the insecticide into the soil surface.

Whether booster doses after the plant came is harvested are necessary to ensure a good second ratoon.

The economic dose rates.

The results of trials harvested in 1960 have partially answered these questions, but have raised the following points on which confirmation will be needed or which will be further investigated through trials being established this autumn:—

Plough-under versus disc-in method of incorporating the insecticide into the soil surface.

Ploughing insecticides under would fit in better with farm practice and would undoubtedly be adopted if it is as effective as discing in.

Is aldrin as effective as BHC?

Would a BHC-aldrin mixture be preferable to either aldrin or BHC separately. Aldrin has a reputedly longer lasting effect.

Other insecticides will be included in some trials and there will be further trials to determine their economic dose rates.

Summary

Results obtained from trials established during 1958 and 1959 are discussed. Good control of soldier fly larvae and subsequent normal ratooning have been achieved by the use of BHC and aldrin. Further trial work based on the above results is outlined.

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[1] **Moller, R. B.: 1958.** "Poor Ratooning in the Bundaberg District". Cane Pest and Disease Control Board's Conference, Minutes and Proceedings, p. 34.

[2] **Moller, R. B.: 1959.** "The Bundaberg Ratooning Problem". Cane Pest and Disease Control Boards' Conference, Minutes and Proceedings, p. 27.

[3] **Moller, R. B.: 1960.** "Poor Ratooning Investigations, Bundaberg, 1955-1960". Cane Growers' Quarterly Bulletin, Vol. XXIII, No. 4, April, p. 112.

Manually Operated Cane Topper

In the last issue of the Quarterly Bulletin (April, 1961, p. 120) we printed some details of a manually operated topper. A photograph of this was also reproduced on page 121 of that issue.

We have been requested to bring before the notice of our readers that Australian Patent Application No. 62740/60 is held for a device of this kind.

The Advantages of Spray Irrigation

By F. ROLLESTON

We are grateful to Mr. Rolleston for setting out the details of a spray irrigation system which he has used successfully on his farm at Eton, near Mackay. He has proved a very important point by showing that a limited water supply can be used to great advantage at critical periods in the growth of the crop. It is felt that Mr. Rolleston's information will be useful to other growers who are considering similar methods.

It is generally realised that irrigation can be of distinct advantage in the growing of a cane crop, but many people are prevented from using irrigation for two reasons:

1. Lack of water.
2. Because the contour of their land is such that it is impossible to get the water to flow without drowning or flooding some of the cane with excess water.

Also, in some cases, where the soil is very porous, a great quantity of water is lost through water soaking away before reaching the other end of a block being watered. In fact, in those instances where for some reason a farmer has had to stop his pump before the water reaches the other end of a porous field, he has, on restarting the pump, had to build up the water in the field again before it would reach the other end, because all the water had soaked away during the interval. In loose soil also, flooding causes the loose soil to erode where the land is rather broken. These comments mentioned here apply to flood irrigation, and it is obvious that with this type of irrigation a much greater amount of water is actually used than would be really required, if it could be evenly distributed.

This is where spray irrigation shows to advantage since it waters the land evenly, giving the high and low portions of the land the same amount. It can be regulated at a rate which will enable the land to absorb the water without undue flooding by excess water. This is very important where small plant cane is being watered. Another very important feature is that it enables a farmer with a limited water supply to obtain the very maximum from every drop of water.

To illustrate this it can be pointed out that it takes 22,700 gallons to cover an acre with one inch of water,

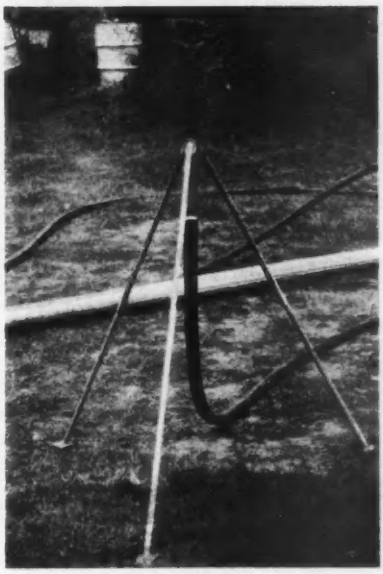

Fig. 1—A close up view of the spray unit.
—photo A. A. Matthews

and it is obvious that a farmer with a supply which would give only a little over 7,000 gallons per hour would be able to apply two inches of water to an acre in six hours. If he

watered for eighteen hours a day he would water three acres a day. It must be remembered that this land would be watered at the rate of two inches in six hours which length of time would ensure a good soaking. Two inches applied in six hours would be better than two inches applied in, say, one hour. On the basis of three acres a day it is obvious that a farmer can water eighteen acres in a six-day week from a supply giving water at the rate of only 7,000 gallons. Spray irrigation of this nature would be superior to any flood irrigation limited to using only 7,000 gallons per hour. At least 20,000 gals per hour is required to achieve any worthwhile results with flooding; even then one would need to have a good flat farm, not too porous.

Fig. 2—A line of spray units spaced about one chain apart.

—photo A. A. Matthews.

It can be seen clearly that in many cases spray irrigation is superior, but the main drawback is the great amount of labour required in shifting the spray lines. With the older type of low pressure spray an area of 35 feet was covered at 15-pound spray pressure. In other words, if a person had a spray line 10 chains long, a strip 10 chains by 35 feet would be watered (approximately half a acre). The amount of water could be varied either by adding more sprays to the line or by using sprays with a larger capacity. If about one inch per hour was considered about the ideal rate and if two inches were to be applied this meant the line had to be shifted every two hours. Sometimes two lines were used, one being shifted while the other was spraying, generally a valve was used to cut down the pressure while the new line was being connected. Usually however, this caused some delay particularly if no valves were used. The only thing to do was to stop the pump while connections to the new line were being made. This caused delay, as say the pump was a quarter of a mile away, well, by the time a person went back to shut down the pump, came back and made the connection, went back and started the pump, and then walked back again to the spray line he would have covered one mile. It is clear that spray irrigation by such a method involved considerable labour as the line had to be shifted every two hours.

Carrying pipes through watered ground is a tiring job.

It was in an endeavour to overcome these disadvantages that we began experimenting with new ideas to cut down the amount of labour required and make the job easier. Having first used the low pressure sprays in 1948 and having carefully studied the technical side of spray irrigation with regard to sprays, pumps, pressures, etc., we had a fair knowledge of the subject and that was how we developed our technique for spray irrigation.

In an endeavour to overcome the need for shifting the line every two hours, we spaced our sprays one chain apart so that on 10 chain line we had ten sprays. These sprays were of the medium pressure type which operated on a pressure of 25 lb to 40 lb as against 15 lb pressure for the old model stationary type. There are several brands of these medium pressure sprays and they use the water jet to make them revolve. The brand we used was Pope "Monsoon", with a coverage of 1 chain wide at about 30 lb pressure, delivery about 12 gallons per minute, so that a 10 chain line with ten sprays, would be putting out 720 gallons per hour per spray or a total for ten sprays of 7,200 gallons per hour. Since a strip of land ten chains long by one chain wide equals one acre, it is clear that 7,200 gallons of water would be applied in each hour; that in six hours about 43,200 gallons would be applied or near enough to two acre inches.

To overcome the need for shifting the line each six hours, we connected one end of a 70-foot length of polythene flexible water pipe to each spray pipe. The other end was connected to the spray mounted on a tripod stand about four feet high and made of light pipe with a flat piece of iron welded at the foot of each leg to stop it sinking in the ground. The polythene pipe stands 65 lb pressure and costs 2/2d, per foot for 1¼ inches, and if care is taken never to allow it to bend or kink it appears durable enough. It might be mentioned that it is our opinion that smaller than 1¼ inch should not be used since the extra pressure required to force the water through even one-inch pipe as compared to 1¼ inch is quite considerable.

The advantage of using the stands for the sprays and the polythene pipe is simply that it enables a person to shift the sprays without shifting the line. For example, if a person starts spraying say with the sprays 70 feet on the right-hand side, it is clear that as the sprays cover a width of some 70 feet then they will be reaching a distance of about 105 feet from the right-hand side of the line. After the sprays have been working six hours these stands are shifted in and placed where the spray line is laid. Then after another six hours the spray stands are shifted out to 70 feet on the left-hand side of the spray line and run for another six hours. It can be pointed out that, during this operation of shifting the spray stands, there is absolutely no need to shut down the pump as the stand can be shifted easily with the spray still in operation and will cause no bother. The fact that the pump can run eighteen hours without stopping is a distinct advantage.

To shift a ten chain line of stands only takes about 15 minutes for one man and, as the stands are light, no trouble is experienced on boggy ground as is the case when carrying heavy pipes. Still another advantage is the fact that only one main spray line is needed. With the old method in which the sprays were fixed directly on the line, a person really needed two spray lines, one spraying and one to shift. Furthermore when a line finished spraying the pipes had to be carried almost at once over the still boggy ground. With the mobile spray idea some time can be allowed to give the water a chance to soak

away as the line need only be shifted once in eighteen hours. The farmer is also saved the expense of the extra main spray line.

Another advantage is the fact that the sprays can be altered to suit the wind whereas with the sprays fixed on the line if a wind sprang up it would carry the water too much to one side and leave dry spots. Another point is that with this method night watering can be practised. It has long been recognised that night spraying has some advantages as, during the day, dry winds and sun can result in a loss as high as 25 per cent of the water sprayed, but at night very little, if any, water is lost from this cause. It is obvious that if a man started his plant at 4 o'clock in the afternoon and let it run until 10 o'clock at night, he could then go to bed and leave the plant operating to cut itself out (if necessary) at 4 o'clock in the morning. Various safety devices are available which will automatically stop an engine should the pump stop pumping, or the oil or cooling water fail in the engine. Time clocks are also available to stop the plant at the pre-set time. Having shifted the spray stands ourselves at night, we would say that this work is no bother at all; if a tractor with a good headlight is used to light up the rows no trouble will be experienced.

With regard to the pressures which piping will stand, it might be pointed out that aluminium piping will stand about 160 lb pressure and galvanised piping about 80 lb, therefore as only 30 or 40 lb is required to operate the sprays either type, if in fair condition, will stand the pressure. A good deal of our piping is galvanised and over twelve years old, yet we have never burst any piping at 30 lb pressure. The pressure range for medium pressure sprays is 25 to 40 lb but we would say 30 lb to 35 lb is ample. If too high a pressure is used the water issuing from the spray tends to atomise and drift away as a mist or fog. If a heavier application of water per hour is required, it is better to use a spray nozzle giving a larger output of water rather than to increase the output of a spray by using greater presssure. These are problems which each person must work out for himself. Two pressure gauges should be used. One on the end of spray line and one on the main line near the pump. The idea of the gauge on the end of the spray is to ensure that full pressure is reaching the sprays since in a long main line, friction will reduce this pressure. The idea of having a gauge near the pump ensures that the pressure never rises above what the piping will stand as this will nearly always be a deal greater near the pump than at the spray line.

Any person, who intends to go in for this type of irrigation, would do well to consult those firms which issue booklets showing how to work out friction heads and water volumes. In this way they will acquire a knowledge of what is required. Regarding water supplies, it is my opinion that there are very many farms which have available an ample water supply if used correctly, yet the owner is unaware of its existence. I am sure that there must be hundreds of farms in this district where with little trouble a supply of 7,000 gallons of water an hour could be obtained and, as I have shown, quite good use could be made of this water. Where the water supply is very good, it may be possible to place the sprays closer than one chain apart. Also, I have mentioned two acre inches as the amount required. However, this depends on how dry it is and the type of soil. The main thing is to be sure the soil is soaked before shifting the sprays, and a farmer will have to work this out himself.

An Elevated Side-Boom Spray Unit

By O. W. D. MYATT

The use of light aircraft for vine and weed control has become established routine in the Herbert River district, some 4,500 acres of cane lands being sprayed annually. Operating during the wet season months, February-April, depending on optimum vine growth, they offer an efficient means of controlling those vines and weeds which are readily susceptible to the hormone type herbicides at a time when well forward cane prevents the use of conventional spray methods.

However, many growers, perhaps jealous of their independence, or wishing to restrict production costs, have this year adopted the use of elevated side-boom sprays. These have proved capable of spraying both vines and weeds in well forward cane crops, where bedded lands allow access for the tractor along regular water furrows; this condition is of frequent occurrence in the majority of Herbert River cane lands.

The side-boom unit shown in the accompanying photographs was planned and built by a local farmer. The 25-foot boom, elevated to 15 feet, Fig. 3 allows a successful coverage of a cane land of 18 rows; whilst the incorporation of a simple turntable, Fig. 4 at the base of the boom enables the adaption of the unit either for change of direction, or as a counter to adverse wind conditions.

Incorporating a conventional boom-spray unit (in this instance a three-quarter inch gear pump), this grower has adapted two Wild's 'Brodjet' jets for his main spray coverage. These have been fitted, one a fixture at the tip of the boom and the second approximately six feet from the tractor but as an adjustable unit along the boom stabiliser bar; to cover the region near the tractor, one Rega knapsack spray head has been inserted in the base assembly of the adjustable jet.

This side-boom unit has proved efficient both for the control of cane weeds and during recent weeks for

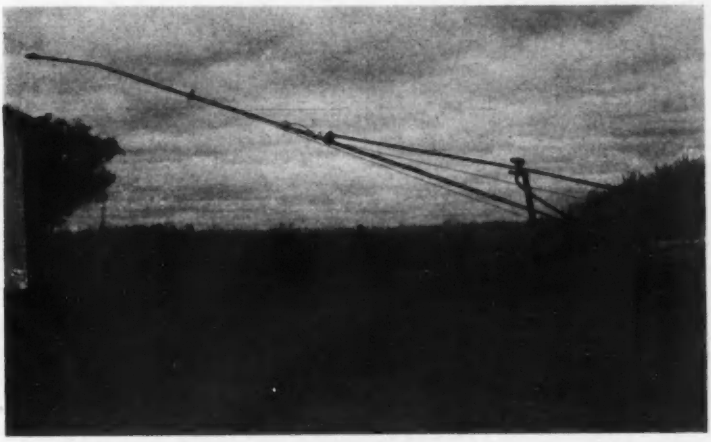

Fig. 3—Showing elevated boom.

—photo O. W. D. Myatt

Fig. 4—A simple turntable at the base of the boom allows for a change of direction.
—photo O. W. D. Myatt

insect pest control work. Although handicapped under extreme wet soil conditions it is capable, when the opportunity offers, of spraying some 80 acres per day at a nominal cost and during a period when other farms activities are limited.

Have Wings—Will Fly

Early in the year Queensland sugar growing districts passed through one of the driest seasons experienced for many years, and it is of interest to consider whether the dry weather brought about any reduction in insect populations.

On the contrary it would seem that insect pests of several categories have flourished. In December, army-worms of one species appeared in plague proportions in districts from Mossman to Tully. Army-worms of another species attacked thousands of acres of cane in Mackay, Proserpine, and Ingham during January and February. Greyback bettles flew in January in as great numbers as has been experienced in any recent year, at Innisfail and in the Lower Burdekin. Bureau field trials with insecticides in northern areas, which have been ineffective during the previous two years because they did not become grub infested, have very useful grub infestations in at least some of them. In Mackay the larvae of Rhyparida beetles were rather numerous, and cane shoots bored by them succumbed quickly in the dry conditions. A species of grasshopper commonly named the spur-throated locust was driven by dry weather from its natural home in the hinterland and flew down to the coast in search of green feed in November. Approximately ten thousand acres were treated during February and March to control the hopper swarms which hatched from eggs laid by these invaders.—G. W.

Mackay Cane Growers Use Contour Banks to Control Erosion

By J. ROSSER

Soil Conservationist, Dept. of Agriculture and Stock, Kingaroy

Messrs. G. Hopf of Kuttabul and T. Whitaker of Sarina are among a number of cane growers in the Mackay area who started using contour banks to control erosion in 1954. Both growers have found the banks satisfactory and they are still using them today. Their experiences are recorded here for the information of other growers who have perhaps felt that some erosion control measures would be of benefit on their steeper land. In addition a brief description is given of the methods actually carried out and which are performing satisfactorily.

The techniques described may be capable of modification and improvement. For example there are possibilities of improving row placement so that all rows have a fall irrespective of the shape of the contours. Again where longer rows than 10 chains are required this would be quite feasible with perhaps an increased bank size or decreased bank spacing.

The banks on these properties were marked out by the author in cooperation with officers of the Bureau of Sugar Experiment Stations in the period 1954 to 1957.

The Erosion Problem in Cane

The majority of Queensland cane growing soils are flat and virtually unaffected by erosion. However, erosion damage is a very real problem on the more sloping country in the higher rainfall regions — or in low rainfall areas where rainfall intensity may be high.

In the period 1948-9 to 1953-4 several soil conservation jobs had been carried out in Queensland sugar producing areas by the Soil Conservation Section of the Department of Agriculture and Stock. These were, in the main, exploratory in nature. The author was associated with one of these jobs when orthodox broad base contour banks were tried in 1949 on the property of Mr. F. Neilsen, Septimus. They proved unsuitable because the channels could not be cleaned out after the cane was plant. With crops that are replanted each year it is not necessary to repair the banks while the crop is growing since maintenance can be performed annually between crops. However, banks cannot be left untouched for the three or four years of the cane cycle. Therefore they must be accessible for maintenance and repair at any time.

Work done at Childers by Mr. J. E. Ladewig, Chief Soil Conservationist, showed that a comparatively small bank leaving just sufficient room for a tractor to get through to carry out maintenance work would prove suitable. Therefore in the period 1954-57 this type of bank was used on several farms in the Mackay area and proved an immediate success.

Layout

The layout was similar to that for orthodox contour bank systems. A typical layout is shown in Figure 5. A big diversion bank at the top of the cultivation diverted all "top" water into a grassed waterway at one side. The waterway carried this water and also served as an outlet for the contour banks. A series of contour banks was built to divert surplus runoff water across the slope into the waterway. Each contour bank had to carry only the runoff from the area between it and the bank above.

Bank Cross Section

The bank used had a V-shaped channel eighteen inches deep and

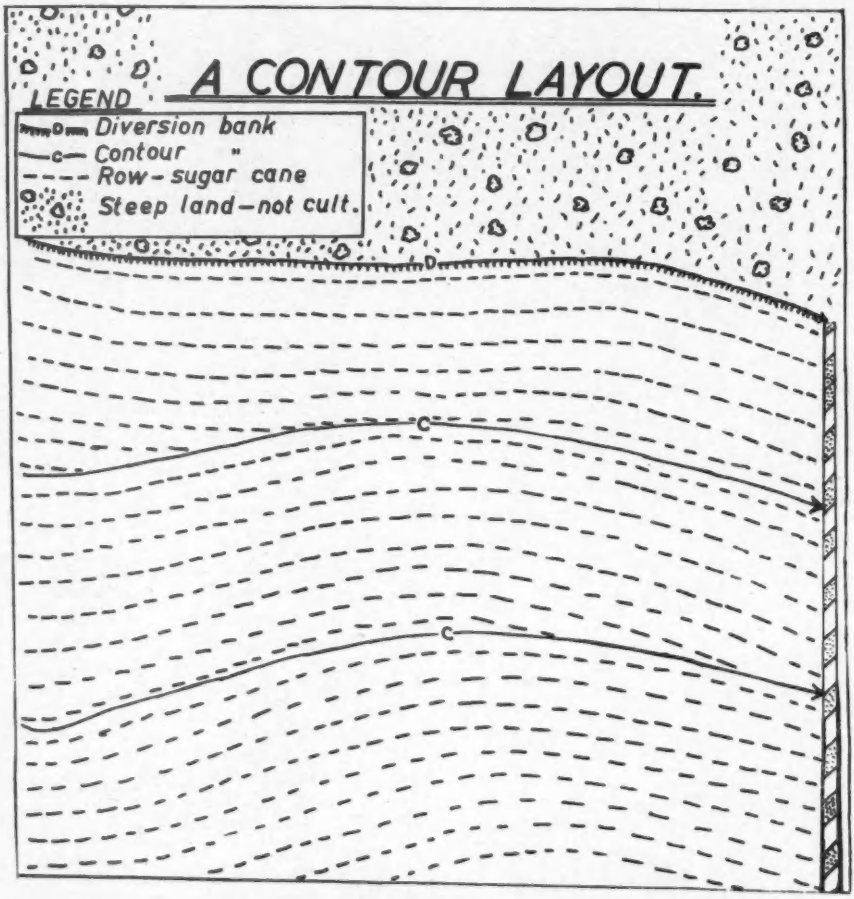

Fig. 5—A typical contour layout. The diversion bank (D) diverts the water at the top of the field in to a grassed waterway on the right. The series of contour banks (C) also run water in to the waterway. The cane rows run parallel to the bank above them.

—sketch J. Rosser

seven feet wide. Two types of cross-section were used. These are illustrated in Figure 6. Both had the same channel dimensions but with a difference in the back slope of the bank. On steep slopes a natural batter was left and the nearest cane row planted 2 ft 6 in away from the bank. On moderate slopes the back of the bank was sloped and the nearest cane row was planted actually on the bank with a saving in amount of ground lost to the bank. In both cases the channel was left un-planted to allow maintenance.

The distance between the row above and the row below the bank was 11 to 13 feet. Extra growth in the rows adjacent to such a narrow space could be counted on to compensate largely for the loss of planted area. This advantage would be lost to some extent with a larger bank. The larger bank would occupy more

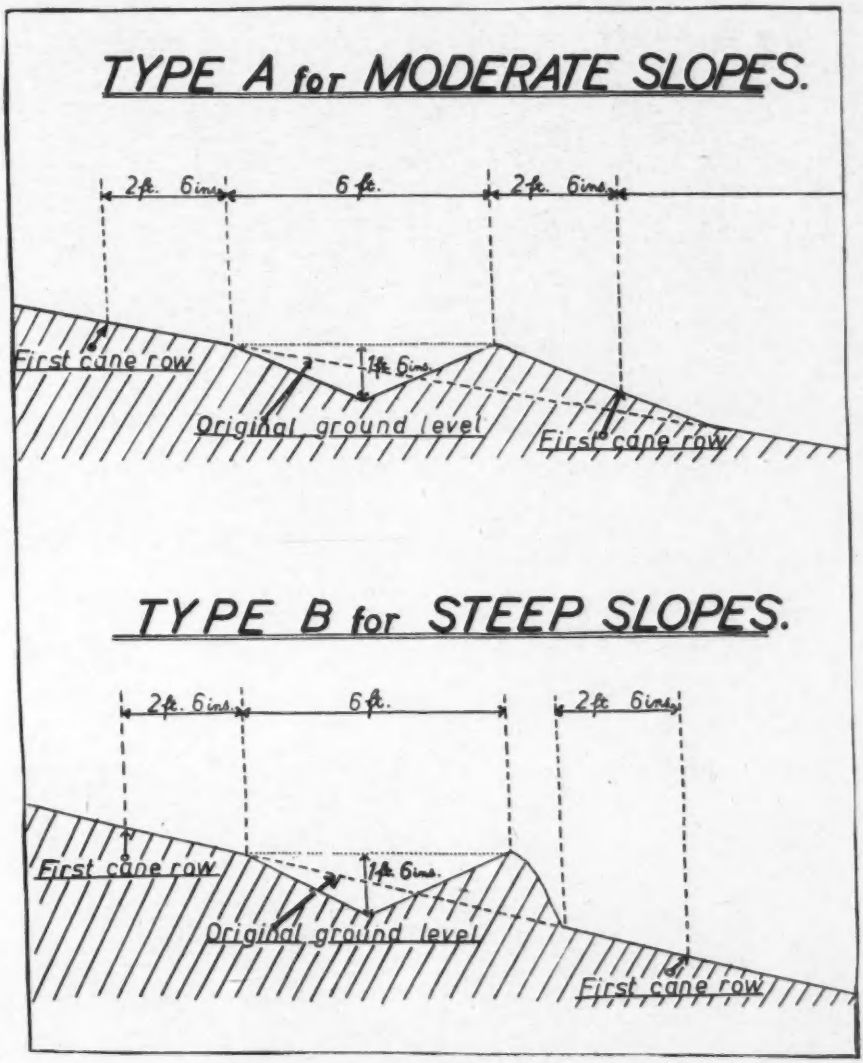

Fig. 6—Two types of contour banks shown in cross section.

—sketch J. Rosser

space and the compensating effect of extra growth in the edge rows would be proportionately smaller.

Bank Spacing, Length and Gradients

The relatively small bank used meant a minimum loss of productive land but also a limited capacity for carrying water. Bank spacings were limited to a maximum of 1½ chains and length to 10 chains so that no bank had to carry runoff from more than 1½ acres. The area to be drained by each bank was thus limited to conform with the capacity of the bank to carry runoff water.

The banks were not in a true contour but had a fall towards the waterway end, varying from 6 inches per

Fig. 7—Cross section of a bank on newly cleared land of 15 per cent. slope. The channel is seven feet wide and 18 inches deep.
—photo J. Rosser

100 feet to 1 foot per 100 feet. The six inches was considered a desirable minimum and was used extensively. Gradient of up to 1 foot per 100 feet was used on steeper slopes. Land slopes treated varied from 5 feet fall in 100 feet to 16 feet fall in 100 feet.

Row Placement

Cane rows were planted parallel to the contour banks. The usual treatment was to follow the upper contour bank and to have any short rows running out into the channel of the lower contour bank.

The planting of the cane rows on the contour was considered the key to success. Once the cane was well grown the contour cane rows themselves would form a barrier against soil movement.

Avoidance of the Wet Season

Final land preparation was delayed until after the main wet season rains. Cane was planted in late autumn or early spring and was out of hand by the following wet season. The wet season rains can be so heavy in the Mackay area that even with the banks it was considered desirable to avoid having bare ground worked fine for planting during the summer months.

Performance

Up to the time of the author's transfer from cane work in early 1958 performance had been very satisfactory. At this time most areas treated had been contour banked just prior to planting. Ploughing out of the old crop and replanting had not been

Fig. 8—Building a contour bank with a farm tractor and grader-ditcher.
—photo J. Rosser

attempted. A period of time has now elapsed and the crop has gone the full cycle. To bring the record up to date, two growers, Mr. T. Whitaker

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Fig. 9—Looking in to the future. A trial plot of new canes being weighed at Meringa Experiment Station.
—photo J. H. Buzacott

Fig. 10—Mr. M. E. McCarthy, Chairman Sugar Enquiry Committee (left); Mr. A. G. Mann. Sugar Experiment Stations Board (centre); and Mr. J. H. Buzacott. Senior Plant Breeder in discussion during the Committee's visit to Meringa Station.
—photo Queensland Cane Growers' Council

Fig. 11—The Little Mulgrave area, near Gordonvale

—photo J. H. Buzacott

Fig. 12—The Bruce Highway leading south through Tully cane lands

—photo B.T. Egan

Fig. 13—Tramway and traffic bridge over the Mulgrave River.
—photo J. H. Buzacott

Fig. 14—A scene in the Upper Mulgrave area.
—photo J. H. Buzacott

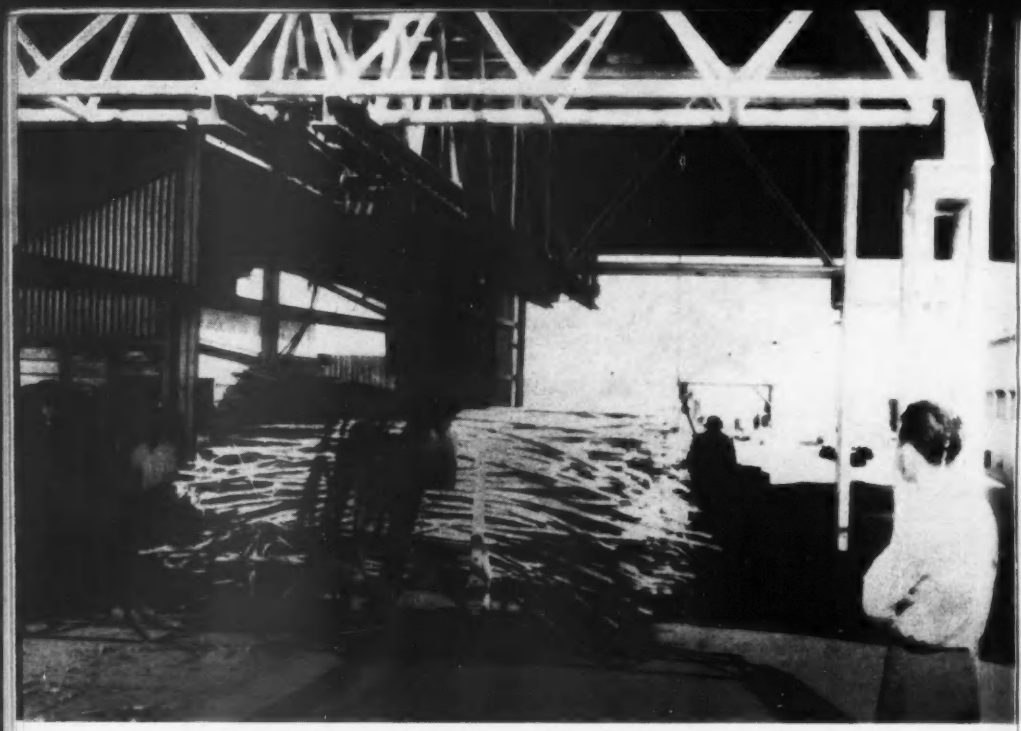

Fig. 15—A mechanical truck pusher at Inkerman Mill. —photo J. H. Buzacott

Fig. 16—Senior field officers of the Bureau at a refresher course, Pathology Farm. Left to right Mr. C. A. Rehbein (Meringa), Mr. L. S. Chapman (Burdekin), Mr. C. L. Toohey (Nambour), Mr. G. A. Christie (Burdekin), Mr. N. Mc D. Smith (Bundaberg), Mr. R. B. Moller (Bundaberg), Mr. S. O. Skinner (Innisfail), Mr. C. G. Story (Mackay), Mr. J. Wesdorp (Burdekin),—In front, Mr. O. W. D. Myatt (Ingham). —photo C. G. Hughes

Fig. 17—Contour banks with parallel cane rows

—photo J. Rosser

and Mr. G. Hopf were contacted by letter in 1960. Their written comments are printed below since they will be of interest to other growers:—

Mr. Whitaker wrote on 13th September, 1960, and provided the following useful information. He said—

"I am still continuing with the contours and find them a great benefit for preventing wash and erosion. They are holding well. The only thing that is giving me trouble is the main drain.

Some points of advantages which I have noted are as follows:—

1. Erosion eliminated.
2. Moisture is held in the soil due to the retarding of the runoff.
3. Crops are definitely improving in yield.
4. Elimination of wet ends.

There is some short work which cannot be avoided but taking into consideration the advantages gained this is a minor disadvantage. I find that it is an advantage to use the front mounted equipment for cultivation. This enables one to look and watch the work ahead. As you know some of my contours have some good bends in them.

As yet I have used the conventional disc plough and mouldboard plough but I intend to purchase a reversible plough this year. I am of the opinion that this is the only way to make a job of ploughing, throwing the furrow-slice uphill.

With the ordinary ploughs when either gathering or splitting, the part with the furrow turned up hill is always the greater. For example, if one gathers, marking out in the middle, the bottom half is cut out before

Fig. 18—Harvesting contour planted cane on sloping land.
—photo J. Rosser

reaching the top bank. Now turn round the next ploughing and split and the reverse is the case; and the mound that was caused in the gathering operation does not coincide with the clean out furrow of the splitting operation.

Other points I consider important are:—

1. Always plant parallel to the top bank—short rows then run into the drain.
2. Drains must be cleaned out and maintained. When the cane is out of hand the last operation should be to clean out all drains —this can be done with disc plough.
3. The soil should be left as level as possible — under no circumstances should hilling up be done.
4. I try to avoid "cutting away" when there is any likelihood of heavy storms. Sometimes this is unavoidable but damage can be caused.
5. I think that contours could be a disadvantage when it comes to mechanical harvesting; a lot would depend on the grade or slope."

Comments from **Mr. Hopf** of Kuttabul on 23rd August, 1960, were also of particular interest and are as follows:—

"My banks are certainly still in good condition although they are not so much banks now but more like drains.

My paddocks have been planted up the second time now and I have ploughed the drains deeper and flattened the bank a bit. That makes it much easier to plant and work the first drill but the change does not alter the size of the drain. I think they will take more water now, than they did originally.

I suppose there is only one reason I have put up with the banks, and that is that I have lost no soil since they have been there.

It is more difficult to work than straight drills and there is a little time used running empty with the

tractor when you get to the short drills. But now I have a particular way I work each awkward bed (most are not awkward at all) and very little time and fuel is wasted.

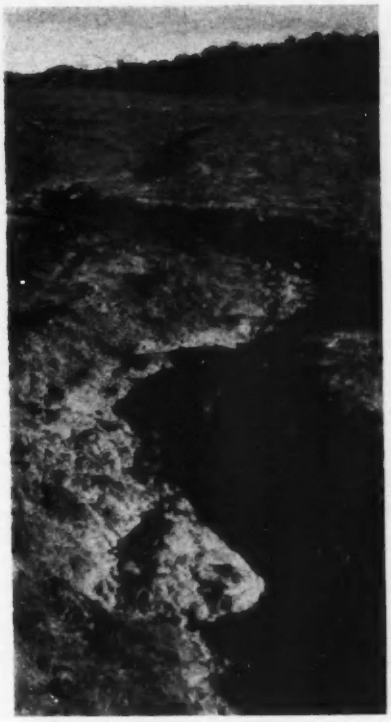

Fig. 19—Severe erosion on fallow cane land. This sandy soil suffered severely.
—photo J. Rosser

Planting presents no difficulties if the drills are marked out first. My equipment for this is a single tine ripper. I start from the bank and work to the bottom of the bed. Then it is only a matter of working in lands and take in the short drills on one side with the long on the other. The only waste time is the drive up the drain until the short drill starts.

The only difficulty with harvesting is picking up the cane with an end loader. The curves take a bit of negotiating but with a little practice it is easy enough.

My crops have improved since the banks have been put in, but to what extent it is hard to say as my farming equipment is improved as well. But I'd say that 80 per cent credit goes to the banks.

I have bought another farm now and it will be all contoured too, before I'll be happy with it. I still have the old place and all paddocks execpt very small ones are worked on the contour. I'll never have them any other way."

Acknowledgements

The author wishes to express thanks to Messrs. Whitaker and Hopf for their co-operation in supplying information on the present condition of their contour banks and for permission to publish their letters.

Thanks are also due to officers of the Bureau of Sugar Experiment Stations, in particular to Mr. C. Story of the Sugar Experiment Station, Mackay, whose advice and assistance was freely given when these early soil conservation jobs were done.

Recording Insect Flights

By B. E. HITCHCOCK

An important part of pest control experiments is the study of the life history and habits of the insects concerned. If the pest is a new one these studies may precede the initiation of control experiments.

Since most insects are winged in the adult stage and fly prior to mating and laying eggs, the recording of flights is important.

With insects such as cane beetles the adults are large and usually fly in large numbers so that flights are readily observed and recorded; but with many pests the adults are small and flights localised in extent so that their occurrence is not so readily detected.

The trap shown in the photograph has been designed to detect localised flights of small insects. It consists of a shallow tray containing light oil above which perpendicular sheets of glass have been fixed in the shape of a cross. Insects blunder into the glass in the same way as they do into the window of a house and fall into the tray where they are trapped in the oil. Traps at present in use have been effective in trapping a large range of aerial insects occurring in cane fields.

Two pests under study at present are funnel ants and soldier flies.

Winged male and female funnel ants can be readily found in the soil but although single females have been taken at lights on two occasions, mass mating flights have never been observed. If mass flights do occur then infestations can be expected to spread much more rapidly than they would merely by gradual extension of the underground tunnels. This is of importance because the rate of re-infestation of areas from which ants may be eliminated by insecticides governs the number of crops against which the cost of control measures can be offset.

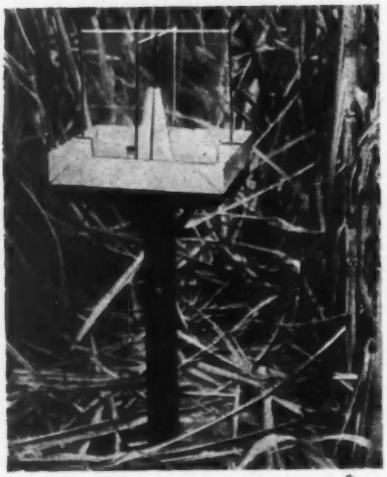

Fig. 20—An insect trap showing glass sheets and catching tray.

With soldier flies the problem is slightly different. Experiments indicate that insecticides should be applied just prior to flight of the adults and left undisturbed. Accurate knowledge of the period over which flights may occur is therefore necessary so that applications can be correctly timed.

The Reasons for High Sugar Content*

By NORMAN J. KING

There has been considerable speculation on the reasons for the sudden rise in sugar content of cane in the 1959 and 1960 seasons, and it is desirable that the available data be examined to ascertain whether these two years form part of a normal or an abnormal pattern.

When considering the rise in sugar content which occurred in 1959 and 1960 the effect of cane variety can be virtually ruled out. There was a considerable changeover from Q.50 to Q.58 in the central area between 1958 and 1959 but the difference in sugar content between these two varieties, and the cane tonnage involved, could not have had any significant effect on State sugar figures. There was no varietal revolution in any district, and the rotational planting system whereby less than a quarter of the gross assigned land is planted each year precludes any major varietal change within a single year.

The effect of length of season has been examined in specimen mills and it has been possible to assess the effect which shortening the crushing season could have on c.c.s. of the crop.

During the crushing season the sugar content of cane follows a pattern which is typical of a district but which varies from district to district. It rises early — sometimes steeply — attains a peak and then falls at the end of the season. With production restricted to peak tonnages (plus, in some years, an extra tonnage acquired by the Sugar Board) and crushing rates becoming higher each year, the seasons are now considerably shorter. Consequently, by examining the *weekly* c.c.s. figures for specimen mills in the pre-restriction period, and then eliminating the figures relating to the over-peak weeks at the end of the season, an average c.c.s. figure can be obtained for the shorter season. Cognisance has been taken also of whether the particular mill began its crushing later in 1959 and 1960 than in the earlier years and the seasonal c.c.s. adjusted accordingly.

Surprisingly, in an examination along these lines of two mills in the north, one in the Lower Burdekin, one in Mackay and two in Bundaberg, the data disclosed some unexpected happenings. Using the figures for 1955, 1956, 1957 and 1958 and reducing the length of season to that of 1960 these points emerged.

(a) Where the shortening of the season was attained by eliminating the latter end weeks, as occurred at three of the mills, the improvement in c.c.s. due to shortening the season was only 0.02, 0.09 and 0.16 respectively.

(b) Where the c.c.s. curve was symmetrical — i.e., the rate of rise early in the season was similar to the rate of fall at the end—as occurred at two mills the improvement in c.c.s. was substantial; it was 1.4 units at one mill and 0.44 at the other.

(c) Where the reduction in length of season was greatest — e.g., there was a six or seven weeks shorter season at three of the mills—the rise in c.c.s. due to the shortening was appreciable—0.4, 1.4 and 0.44 units of c.c.s.

A campaign in most mill districts in recent years, directed at obtaining a cleaner cane supply, has had some minor effect in the direction of higher sugar content. This is explained by the fact that cane stalks have been topped back more severely and the immature top portion of the stalk eliminated. However, this has not

*Extracts from evidence given before the Sugar Enquiry Committee—1961.

been universal, by any means, and the contribution towards higher State average c.c.s. would be small.

On the subject of fertilizer usage there is no evidence that the sugar content of cane was affected thereby. There was, in certain recent years, a drop in overall fertilizer usage but since the drop would have been from normal to sub-normal quantities the sugar content of cane would not have suffered.

Age of cane is an important factor in sweetness of the crop. The term "age of cane" is used here, not to indicate the elapsed time between planting and harvesting, but the actual age of the various portions of the stalk at harvest time. In some years when climatic conditions are favourable there may be a couple of feet of cane developed before the end of the calendar year; in other years there is none. In the latter instance, and assuming that the block were harvested in July—even the butts of the cane would be less than seven months of age at cutting time. In the former case, the butts may be a month or more older and have had that extra time to store sugar.

The amount of sunlight falling on the crop has long been associated with its sugar content, and some evidence has been obtained to indicate that a lot of cloud at the period of maximum growth can reduce the rate of sugar synthesis and storage. Investigational work in Hawaii proved that both cane growth and sugar content of the cane were improved by extra sunlight. The effect on the growth factor is shown in the accompanying graph, but the report of the investigation also says "A further study involved cane growing in identical soil at two different locations one of which was sunny with few rainy days, and the other characterised by many wet days and less than half the sunlight. The resultant crops showed that the cane in the sunny climate had nearly three times the weight of cane, nearly five times the weight of sugar, and 28 per cent higher sugar content."

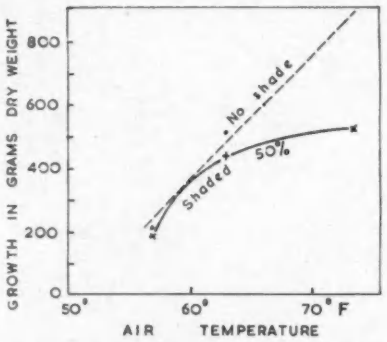

Fig. 21—Illustrating the decrease in weight of sugarcane when the amount of sunlight was reduced by one half

Another investigation along similar lines was conducted in Queensland by the Bureau of Sugar Experiment Stations. Sunshine recorder instruments had shown that there was approximately 25 per cent less hours of sunlight in Babinda than in the neighbouring Mulgrave mill area. Accordingly, in the latter area, frames were erected over small areas of cane, the frames being covered with metal strips to the extent of one quarter of their area and constructed in such fashion as to enable their being raised progressively with the growth of the cane. In this way, the amount of direct sunlight falling on the crop was reduced to 75 per cent of the outside figure. The photograph shows the arrangement. The shading produced a statistically significant reduction in both sugar content and weight of cane with the variety Pindar. The sugar content from the shaded area was only 83 per cent of that from the non-shaded.

Of the factors discussed above, it is considered that, on the basis of experimental evidence or examination of figures, the most important items contributing to high c.c.s. in the 1959 and 1960 seasons were

(1) Age of cane
(2) Amount of sunlight in the period of maximum growth
(3) The dry and sunny harvesting seasons.

In regard to (1) it is shown below that prior to the 1959 and 1960 harvesting seasons the rains in the preceding November and December were very favourable for early growth, and the table shows the total of November and December rainfall at three Sugar Experiment Stations.

These conditions brought about rapid stalk elongation before the end of the year thus giving a reservoir for the storage of sugar. These are the conditions favouring greater age of cane.

The argument relating to the effect of hours of sunlight in increasing sugar content of cane is supported by some sunlight measurements made in both Babinda and Meringa areas; the former is classed as a lower sunlight district and the district c.c.s. in proverbially low. The aggregates of January to May (inclusive) hours of sunlight are shown below for the past three years.

The differences between 1959 and 1960 are marked and it was between these two years that the average c.c.s. in those districts rose 1.21 units in Babinda and 1.32 units in Mulgrave (where Meringa is located). Between 1958 and 1959 when the hours of sunshine did not increase (at Babinda there was a decrease) the c.c.s. dropped by 0.13 in Mulgrave and 0.37 in Babinda. It is not suggested that the hours of sunlight in the January-May period was the only operative factor in c.c.s. variation, but it was an important one.

Inserted herein is a graph which shows annual quality ratio figures (tons of cane required to make a ton of 94 net titre sugar); these are, similarly, a measure of the sugar content of cane. It will be seen that, over a period of forty years the figures fall into two groups. The figures have been used to construct trend lines. From 1921 to 1940 there was a trend towards sweeter cane and this period coincided with the discarding of such of the old noble canes as had low sugar content, better sugar recovery in the factories, and the introduction of new, sweeter canes in the south. From 1940 onwards, however, the trend line takes an opposite direction, brought about by the large scale change-over to more vigorous, hybrid cane varieties with less well defined maturing characteristics. In

Fig. 22—The shading trial carried out in North Queensland. The metal slats reduced the sunlight by 25 per cent.

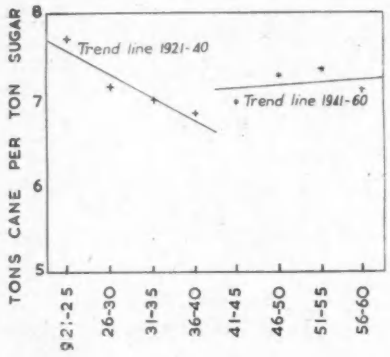

Fig. 23—Showing the trend in sweetness of sugar-cane in the periods prior to and subsequent to 1940.

1934—to select a year from the first period—the Queensland crop contained 91.9 per cent of noble canes; by 1959 the figure had dropped to 7.2 per cent.

The conclusion to be drawn from this data is that the high sugar content of the 1959 and 1960 crops was not, in general, the result of any man-induced development in the industry. Varietal changes were not sufficiently marked as to exert any signicant influence; the effect of increased cleanliness of cane would be small; and reduced fertilizer usage could not have been significant when taken hand in hand with the persistence of high yields. But some of the factors which are not controllable did favour higher c.c.s. in cane. These included increased sunlight hours in the wet season in 1960, advanced stage of cane crops at the end of the year prior to harvest, and a very dry harvesting season in 1960.

It is the writer's considered opinion that these last-mentioned factors were the ones which caused the jump in sugar content from 1958 to 1959 and from 1959 to 1960.

The trend lines calculated from cane/sugar ratio figures over a period of 40 years demonstrate that, since 1940, there has been a progressive decrease in sugar content and that the 1959 and 1960 figures do not belong to the normal and anticipated pattern.

In the forthcoming 1961 harvesting season it is anticipated that the sugar content of cane will be low. This forecast is based on the backward state of the crop—there was no cane formed before the end of the year—and the expectation that when the wet season does arrive the period of maximum growth will include periods of reduced sunlight.

November plus December Rainfall	Meringa	Mackay	Bundaberg
1958 (for the 1959 crop)	4.10	10.31	7.86
1959 (for the 1960 crop)	9.10	16.03	11.89

District	Aggregate hours of sunshine January to May (incl.)		
	1958	1959	1960
Meringa	822	823	981
Babinda	752	656	829

Chlorotic Streak Disease Can Spread in Flood

By B. T. EGAN

Chlorotic streak disease has been recognized in Queensland as a separate disease since the late 1920's, and pre-war was known to be present in the area from Mossman to Ingham, at Proserpine and at Nambour. Since then it has been found in all other cane-growing areas, the last affected being the Burdekin, where it was discovered in March, 1960. These outbreaks in previously clean districts were discovered in the early stages but efforts to eradicate the disease were unsuccessful. However, the outbreaks at Mackay and Bundaberg did provide excellent opportunities for observations on the manner of its spread throughout a district. It soon became apparent that water, particularly flood water, played an important part in the dissemination of the disease, and several instances occurred of diseased blocks near headwaters of creeks infecting the whole drainage system. Spread along some drainage ditches could also be traced back to diseased blocks.

In an endeavour to prove this theory of water-borne infection, an experiment was set up at the Northern Sugar Experiment Station. Healthy cane was grown in troughs of nutrient solution, some being supplied with water from the Cairns town supply while others received water taken from drainage ditches in an area where chlorotic streak was prevalent. Figure 24 shows such a ditch, and many of the stools of cane visible were diseased. The experiment took place during the dry season of 1959, i.e., August to December, and no transmission of the disease occurred. However, a repeat experiment was commenced in April, 1960, and by August the first chlorotic streak disease symptoms were seen in the cane which was getting a weekly supply of ditch water. No disease has yet been found in the cane receiving the town supply water, which is obtained from a creek high up in the rain forrest.

Fig. 24—Collecting ditch water in a chlorotic streak area at Babinda.

Aldrin Controls Funnel Ants

BY G. WILSON

The control of funnel ants in cane fields is emerging as a practical, economic possibility as the result of work carried out by the Bureau over several years, and while the method evolved at the present time may be modified in the light of further experience, growers can benefit by putting the recommendation into effect at the first opportunity. The method recommended consists of applying aldrin, at 12 lb. per acre, as a broadcast spray on the soil, and mixing it in by discing, before the last ploughing prior to planting. That application should give adequate control of the ants for the normal cycle of plant and two ratoon crops.

The first commercial use of this control will be of considerable interest, and it is suggested that growers employing it should seek the co-operation of their Pest Board's supervisor, firstly to ensure obtaining supplies of aldrin at the lowest cost, and secondly, to ensure that no errors in its application should occur. The most convenient means of application is by boom spray, and such factors as correctly measuring the tank, and calibrating the volume of liquid applied per acre at normal working speed and spray pressure should be carefully checked. Aldrin is available in liquid form and the amount of the commercial product required to provide 12 lb. of aldrin per acre must be calculated according to the strength of the aldrin concentrate. For example, a 40 per cent concentrate contains 4 lb. per gallon, and a 60 per cent concentrate contains 6lb. per gallon; consequently three gallons of 40 per cent, or two gallons of 60 per cent concentrate will be required per acre. When filling the tank allowance must be made for the gallons of aldrin concentrate added to the water; for example, if the boom spray is calibrated to deliver 20 gallons of liquid per acre, the three or two, gallons of aldrin concentrate must be added to 17, or 18, gallons of water respectively, not to 20 gallons. The aldrin and water should be thoroughly mixed, and since aldrin is a poison which can be absorbed through the skin, any contamination of the hands or other area of skin should be washed immediately with soap and water after each filling of the tank. Care should also be taken against inhaling any of the fine spray particles.

This method of control may be improved on by future trials with varying amounts of aldrin and modified methods of application, and the Bureau is also investigating other promising insecticides. It is not possible to predict, at this stage, whether it will be necessary to repeat the full 12 lb. application each time a field is planted; a field trial to determine this point has been arranged for. Several growers are applying aldrin this year, and it will be of interest to note whether, ant infestation becomes re-established in the 1964-5 legume crop.

Fig. 25—Spraying aldrin on a funnel ant trial.
—photo G. Wilson

The Value of a Cover Crop

BY A. A. MATTHEWS

Growers are well aware of the benefits to be obtained from growing a legume crop. A cheap source of nitrogen and the control of erosion are two that readily come to mind. During 1960 another important benefit was very noticeable in a legume trial situated on the property of R. S. Stevens and Son, Racecourse.

The trial was initiated in October, 1959, when several plots were planted to velvet bean while other plots were left as a weed and grass fallow. The variety Q.63 was planted in the trial area on the 7th July, 1960 and this crop was to be used to test the efficiency of legumes to supply nitrogen to the following cane crop. During cultivation of the young plant cane it was observed that the plots which had a cover crop during the fallow period has a smaller population of nut grass than had the check plots. These check plots were not cultivated during the fallow and natural weeds and grasses were allowed to flourish. Because of the growth of nut grass in the check areas, it was necessary to give extra cultivations to the young plant cane.

The accompanying photograph taken on 22nd November, 1960, shows the difference in vigour between the cane following grass fallow on the left and that following green manure fallow on the right. Although not discernible in the photograph, the population of nut grass was much higher in the grass fallow plot than in the legume plot.

Although it is realised that some of the benefit may be due to nitrogen supplied by decomposition of the legume residues, it is felt that the difference in growth is too great to be due solely to this factor. Normally the Mackay district experiences a dry spring and from July 7th until the middle of November, 1960 only 103 points of rain were recorded. It is considered that the competition for moisture between cane and nut grass

Fig. 26—Showing the difference in growth between the cane following grass fallow on the left and the much better cane following green manure fallow on right.
—photo A. A. Matthews

was the major factor causing the poorer growth in the check areas. This opinion is strengthened by the fact that in a similar trial where nut grass is absent there is no difference in the growth of the cane following grass fallow and that following green manure.

When the trial was inspected in November there was no difference in colour between treatments but the cane in the check areas was showing more distress from lack of moisture than the more advanced cane in the legume plot.

From the above ex erience it would pay a grower to grow a good cover crop to prevent the build up of nuts during the fallow. This, coupled with intensive scarifyings prior to planting should assist considerably in controlling nut grass. Similarly growers who are troubled by guinea grass could profit from a cover crop which would prevent guinea grass growing and seeding on fallow blocks. It may be necessary in this instance to increase the sowing rate of the legumes.

Primary and Secondary Infection

It has been noted that occasionally there appears to be some confusion in the minds of those dealing with diseases in the cane fields of Queensland as to the distinction between primary and secondary infection. This brief note seeks to explain the distinction as it applies to sett-transmissible, infectious cane diseases.

Primary Infection

As the term implies, primary infection is that which is present in the material from which the crop arises. Thus, in a plant crop of cane, primary infection would be that existing in the setts when planted; in a ratoon crop it would be that in the stool. Although the disease may be initially present in the sett or stool, as the case may be, the first positive signs of infection may not appear for quite a long time. Infection with ratoon stunting, for instance, may show in the pink blush in the young cane, but it is possible for the cane to reach maturity before definite diagnosis can be made. A similar non-development of symptoms is characteristic of leaf scald and it can also happen with chlorotic streak and gumming. On the other hand, diseases such as downy mildew, dwarf, Fiji and mosaic usually show their diagnostic features as soon as the shoots are of sufficient size.

Secondary Infection

Secondary infection is said to occur when the disease spreads in the growing crop, even if the crop were initially clean and the infection came from outside. Usually, of course, secondary infection comes from foci of infection already present in the field. It is possible for more than one cycle of infection to occur in the one crop; a stool which itself has acquired infection during growth can act as a source of infection for further secondary spread. This effect used to be seen often when gumming would first get into a block of a susceptible variety. The initial spread by wind-blown rain would set up secondary foci of infection which in turn would spread the disease further when more storms occurred. Other diseases may also show more than one cycle. The fungal disease, downy mildew, commonly showed it, leading to a sudden build-up of the disease within the affected block. Virus diseases, such as Fiji and mosaic, which are spread by insects, may also act in a similar fashion especially if the crop be carried over and the insects thus left undisturbed for a relatively long time.—C. G. H.

Coot Damage to Sugar Cane in the Proserpine District*

By R. H. ROBINSON

Supervisor, Proserpine Cane Pest and Disease Control Board

The Coot or Red Bill, has been responsible for considerable damage to both mature cane and young plant and ratoon cane in the Proserpine area. Over the past two years, 1959 and 1960, more of these birds than were formerly noticed have been moving on to farming areas from the surrounding swamp lands.

Damage to the cane generally occurs from March to July, although there is no fixed rule about this and slight damage will occur throughout the year. Although the damage done by coots to the mature cane is similar in many ways to rat damage, it is generally of a more spectacular nature, for whereas coots mostly feed on and destroy almost every stalk in a patch of cane on which they are feeding, rats will travel through a block eating stalks here and there. Coots also differ from rats in their method of feeding. Whereas the rat generally feeds on the internodes only, leaving the harder nodes and thereby producing a long sausage-string effect on the stalk, the coot in most instances will start near the bottom of the stalk and, stripping back the rind, will continue along it eating the soft interior portion, including the nodal tissue. The entire stalk is thus hollowed out.

In their camping areas, considerable damage is done to mature cane by the coot's habit of roosting in the foliage and breaking down the leaves. Furthermore the young plant or ratoon cane is not free from the depredation of these pests, as they will eat out the young tender heart of the immature stalks.

Considerable success was achieved, in the control of coots by poisoning.

It was noticed that where these birds congregated, following harvest, they were feeding on the exposed portion of the stubble. Stalks of cane were cut into 18-inch lengths, a small hole about a quarter of an inch deep was made in one end of the cut portion and a few grains of strychnine placed in the hole. The short length of cane was then pushed into the soil leaving approximately one foot of the treated end above the ground.

In this experiment the baited stalks were placed along a water furrow, one to every two chains, the reason for this being that a better check could be kept on the baits and that the coots generally congregate along water furrows. Thirty-four dead birds were found after two days, for 36 baits laid. The birds then left the block.

The split stalk method was also tried. Eighteen-inch lengths of cane were split down the centre and the strychnine introduced into the soft interior. This baited cane was also placed along the ground in a water furrow. In this instance, however, only seven dead birds were found. Since the baits were placed in a reasonably heavy crop of standing cane, there is the possibility that not all the dead birds were found.

It can be seen that the former method gave much better results than the latter, while the baits were much easier to prepare and to handle. It was also found that freshly cut cane was more attractive to the coots than cane that had been cut into lengths and left for two or three days.

*Read at the 1961 Annual Conference of Cane Pest and Disease Control Boards.

An Army-Worm Outbreak in the Mackay Area in 1961*

By C. G. STORY

Annual army-worm, *Pseudaletia unipuncta*, visitations are expected in the central area. Normally these are of no consequence because natural parasites limit abnormal population increases. Seasonal conditions from the end of May to the good rain which occurred during the last week in December, 1960, were unfavourable for the production and survival of large populations of parasites. The rain at the end of December produced good grass growth in many blocks of plant cane and this grass induced moths of the army-worm to lay their eggs there. Caterpillars, developed from eggs laid by moths of *P. unipuncta* during this period and under these conditions, were responsible for the severe defoliation of cane which took place at the end of January, 1961. The first damage was reported in the Te Kowai area on 25th January. Severe defoliation of many blocks occurred in the district during the period of the main attack, 28th-31st January, 1961. Counts indicated 11-17 caterpillars to one leaf. Though normally a night feeder, the infestation was so heavy on some blocks that large numbers of caterpillars could be found defoliating leaves during the day or hiding in the spindle. These caterpillars made quite a noise when eating.

The initial severe attack started to wane after the 1st February. Many of the caterpillars responsible for the original severe defoliation had pupated behind lower leaf sheaths or in the ground by the 3rd February. Pupae of parasites were also present. The major attack in the main area concerned had finished by the 6th February, but sporadic light outbreaks continued in other parts of the district. There was a large emergence of moths on the nights of 14th and 15th.

Varieties attacked were Q.58, Q.63, Q.68, Q.57, Q.50, Trojan and Pindar. The principle of control was to confine caterpillars to the damaged areas by spraying strips up to six feet wide around the perimeter of such areas with 25 per cent D.D.T. at the rate of one part in 200. Minimum amount of spray was 50 gallons per acre. Knapsack sprays, inter-row and boom sprays were used successfully. BHC dust applied in bands was another method of control. Despite early action on the 31st January to obtain a plane, aerial spraying did not commence until 7th February. This was 7-10 days too late for beneficial results to be obtained with the initial outbreak. However, this machine did useful work on odd blocks which were the centre of a late attack. A total cost was 38/- per acre, using 2½ pints of 25 per cent D.D.T. in 3 gallons of water per acre. Both shoulder mounted and tractor mounted misting machines showed possibilities. A second attack in the district would not be as severe because of the presence of Braconid wasps, Tachinid flies and a bacterial disease which would assist in control. Odd caterpillars of *Mocis frugalis* were also present during the initial outbreak.

Although a new top had been produced in severely defoliated cane by the 25th February, 1961, it is difficult to assess the resultant crop loss. However, Bureau defoliation trials conducted during 1947-1948 showed that losses of about two or more tons of cane per acre could be expected from a single defoliation carried out at this time of the year. This loss, combined with consequent weed growth, would show a debit compared with the cost of control.

*Read at the 1961 Annual Conference of Cane Pest and Disease Control Boards.

An Army-Worm Outbreak in Northern Queensland in 1961*

By G. WILSON

In the last week of December, 1960, infestations of the army-worm species, *Laphygma exempta,* occurred on a large number of farms in the Hambledon, Mulgrave and Babinda mill areas, and to a lesser extent at Mossman, Innisfail and Tully. First reported at Hambledon on 28th December, and at many points throughout the mill areas referred to by the 30th, the army-worms were detected in almost every instance while still concentrated in grass, with only a small proportion invading cane crops. One field, however, was seen on a creek flat, where there was much grass amongst the cane, which appeared to be the focal centre of an outbreak which seemed to completely defoliate the cane in one day. Although the infestations occurred in rainy weather, following several months of very dry conditions, their initiation was not clearly associated with any definite date of change in the weather pattern, because in the Babinda and Innisfail areas beneficial rains totalling several inches had fallen during a period two to three weeks in advance of the breaking of the drought in the Mulgrave and Hambledon areas, yet the outbreaks of army-worms in these northern centres were almost simultaneous.

The detection of the pests in the early stages, before they had penetrated far in to cane fields greatly simplified and reduced the cost of control measures, which consisted in the main of laying a band of 20 per cent crude BHC dust on the ground between the advancing army-worms and the cane crops, and then dealing with the main body of each infestation with either D.D.T. spray or BHC dust. On some farms army-worms in unimportant numbers penetrated well into cane fields, and in a few of these instances growers carried control measures to unnecessary lengths by applying chemical control throughout the fields by means of knapsack sprays or rotary dusters, mechanical application being impracticable because of the height of the cane or the wet condition of the soil. Some Cane Pest and Disease Control Board officers had chosen that usually slack period of the year for their recreational leave, which resulted in a greater than usual number of enquiries for advice being directed to the Sugar Experiment Station at Meringa, but the simple control methods required were easily conveyed to growers, even by telephone. One Board, bereft of its field staff, showed an excellent example of service and organisation by delegating the growers on the Board to act in an advisory capacity each in the division of the area most convenient to his residence.

At the outset it appeared possible that extensive damage could occur, but the prompt reaction of the majority of growers, in spite of the handicap of unfavourable weather, resulted in only a minority of fields sustaining appreciable defoliation. The most extensively damaged individual farm did not come to the writer's attention until the 3rd of January, by which time 60 of the 110 acres on the farm were completely defoliated. Unable to apply control by hand on so large an area, the grower had arranged for aerial spraying, but rain and low cloud delayed the operation. Spraying on the 4th January with D.D.T. at one pound per acre resulted in a complete kill within 24 hours. Although the affected fields could suffer no further damage, the grower persisted with the spraying to prevent the army-worms moving into cane not then infested. How-

*Read at the 1961 Annual Conference of Cane Pest and Disease Control Boards.

ever, army-worms at all points throughout the affected districts commenced entering the soil to pupate on the 5th, and all except occasional stragglers had disappeared by the 8th. On the 5th many of the larvae appeared still only half grown. Intermittent moderate rain had accompanied the infestation, but on the 7th the rain intensified into a heavy downpour and whatever may have been the cause of their disappearance, army-worms were not in evidence after that date.

During the early stages of the infestation the tendency to march was strong. Army-worms on creek flats, with ample grass and cane available, moved up steep banks through blady grass, feeding on it in passing, and gained higher ground; on level fields the army-worms left grass and crossed bare ground in close army-like formation, moving towards cane crops. Many of the infestations originated amongst legume crops in which there was some grass, but no feeding on legumes was seen to occur.

On the 9th January, pupae were plentiful in the soil at depths of from half an inch to one inch, resting in a generally vertical position, head uppermost. In a field which was almost completely defoliated, no control measures having been attempted, the writer collected approximately 100 pupae from two square feet of interspace. Pupae collected on the 9th and 12th of January yielded 20 per cent moths on the 16th and 17th, but only large Tachinid flies, as yet unidentified, emerged thereafter. Tachinid fly puparia were found in a high proportion of the moth pupal cases, and fly puparia free in the soil, as would have resulted from the premature death of army-worm larvae, were scarce. It was deduced that parasitism was at a very low level during the early stages of the outbreak and built up too late to reduce the feeding period of any great proportion of the army worms. In such circumstances, sufficient moths can be expected to emerge to give rise to a second generation of appreciable intensity about four weeks after the original outbreak. That eventuated to a limited extent. Further outbreaks occurred from the 24th of January to the 1st February, but of those seen, only one was sufficiently extensive to warrant control measures. In that outbreak a small proportion of the army-worms were seen to bear the white eggs of Tachinid flies attached on the top of the head.

From 181 army-worms collected on the site, 17 Tachinid flies, *Actia nigritula* emerged, and 14 moths; the remainder of the larvae died, apparently from bacterial disease. In the last infestation reported, on 1st February, in bright sunny weather bacterial disease was killing a high proportion of the pest and control measures were obviously unnecessary.

In the 60 acres of completely defoliated cane referred to above, the rcovery of the foliage was estimated as 15 per cent of normal leaf area eight days after the spraying; 21 days after spraying the foliage was normal, or very nearly so, but none of the new leaves had reached the stage of beginning to shed.

The 1960 Cane Crop

During the 1960 crushing season Queensland's 31 mills crushed 8,685,426 tons of sugar cane. This tonnage was harvested from 327,246 acres, and the average yield of cane per acre was 26.54 tons.

In summarising the cane varieties which contributed to the total crop it was found that they originated as follows:—

Origin	Tons cane	Per cent of crop
Bureau bred	4,017,730	46.3
C.S.R. bred	3,294,875	37.9
South Africa	625,187	7.2
New Guinea	42,414	4.9
U.S.A.	293,921	3.4
Indonesia	22,048	0.2
India	10,251	0.1

FREE SERVICES TO CANE GROWERS

The Bureau offers the following free services to *all* cane growers in Queensland:—

Soil Analysis and Fertilizer Recommendations

Your soil will be analysed by the most modern methods, and a report will be posted containing a recommendation covering the type of fertilizer required, the amount per acre, the need for lime, and other relevant information. Phone the nearest Bureau office and the soil samples will be taken as soon as possible.

Culture for Green Manure Seed

Cultures and instructions for the inoculation of the seed of cowpeas, velvet beans or mung beans will be posted to any cane grower upon request to The Director, Bureau of Sugar Experiment Stations, Brisbane. Allow a week after receipt of your letter for the culture to be prepared and posted, but as the culture will easily keep a month or so it is a good idea to get your culture when you get your seed. If sowing is delayed, ask for another batch of culture; there is no charge.

Advice on All Phases of Cane Growing

The Bureau staff is at the service of all cane growers. They can best advise you on matters pertaining to varieties, fertilizers, diseases, pests, drainage and cultural methods. Bureau officers are available in every major cane growing district. A phone call will ensure a visit to your farm.